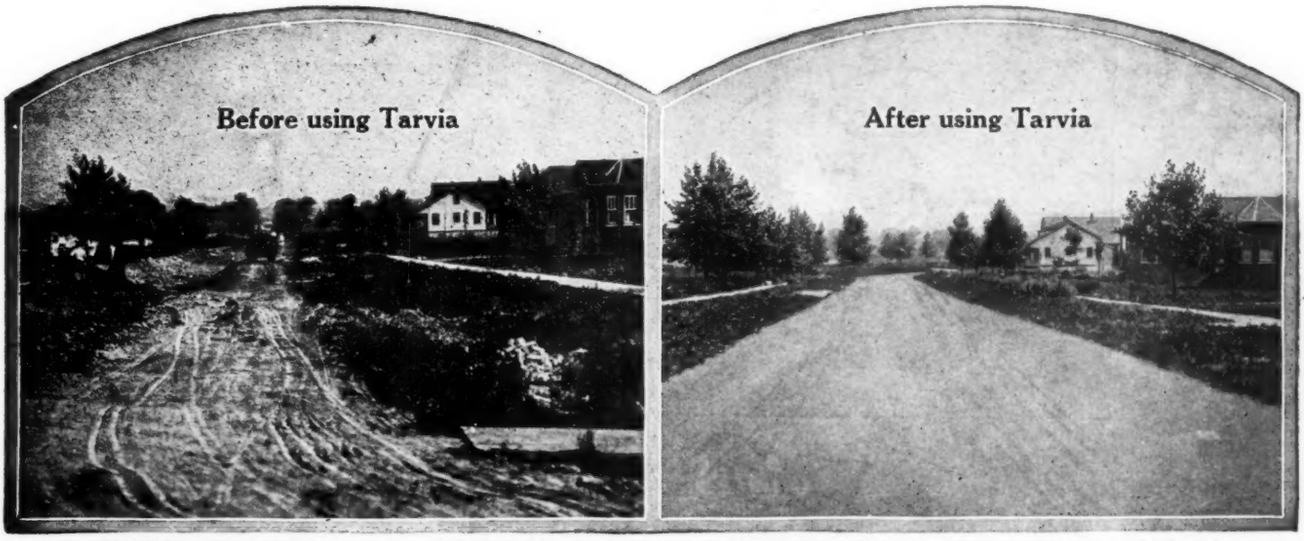
JUL 11 1921

PUBLIC WORKS

CITY COUNTY STATE



Wretched condition of Kenilworth Avenue, Villa Park, Ill., before *the use of Tarvia*

Picture of same section after *being constructed with "Tarvia-X." Note excellent condition of road today*

Good Roads Boost Property Values—

YOU can easily see how Tarvia has improved property values along Kenilworth Avenue, Villa Park, a pretty suburb of Chicago, Ill.

Here was a stretch of road that was bumpy and "hard going" on even the best of days, while during the Spring thaw and after a heavy rain, it was practically impossible to navigate.

That was its condition before the road authorities of Villa Park turned to Tarvia. Tarvia will make this road last for years. With but occasional inexpensive treatments with "Tarvia-B" as the traffic demands it, it will always be free from mud and dust, waterproof, frost-proof and traffic-proof. It has increased the desirability of the abutting property many hundred per cent.

For these reasons Tarvia streets have the hearty approval of taxpayers everywhere. The story of Kenilworth Avenue is being repeated in many cities and towns all over the country.

Tarvia is a coal tar preparation for use in constructing new macadam roads or repairing old ones. One Tarvia road in your community will prove to you and your townspeople how Tarvia roads increase property values and decrease taxes.

Illustrated booklets free upon request

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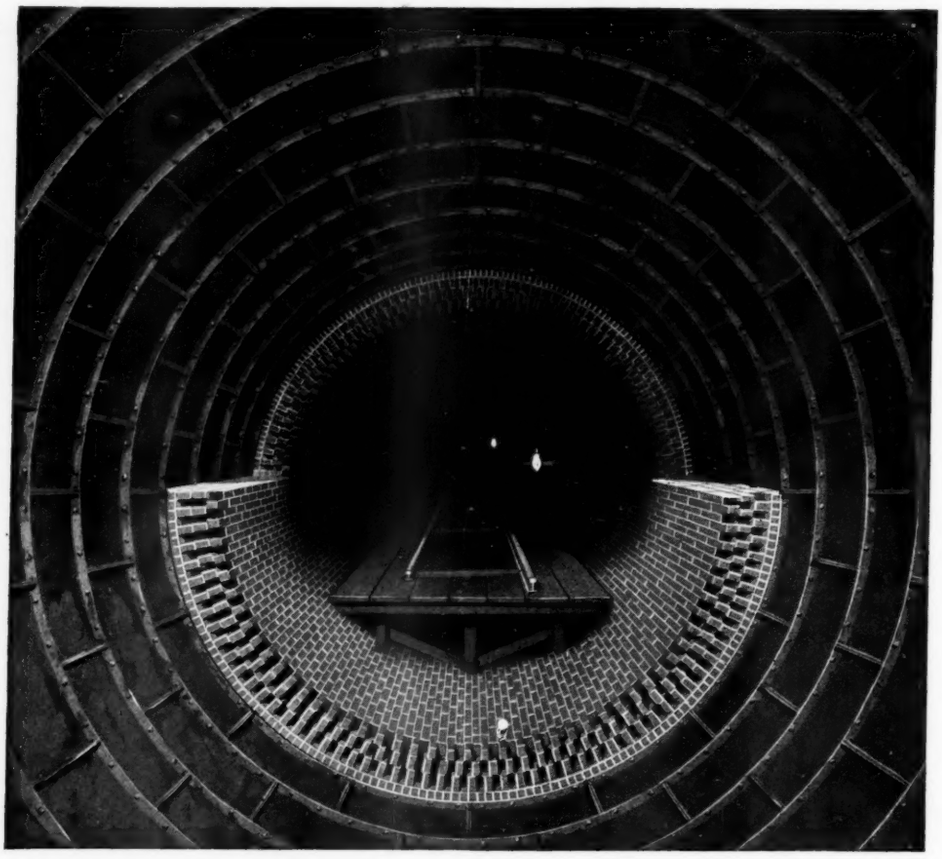

Truscon Tunnel Liner Plates, Seven-Mile Road and Gratiot Ave. Sewers, Detroit, Michigan. Outside diameter of sewers, 12 ft. to 13 ft. 8 in.

Truscon Tunnel Liner Plates

The modern method of tunneling under ground is to use pressed steel liner plates to support the earth. These liner plates consist of flanged sections which are bolted together, making a continuous rigid shell which can be carried forward a considerable distance in advance of the masonry. They are equally satisfactory if used with brick or concrete. Removable steel forms can be used for the inner face of the tunnel.

Safety to the workers is assured by providing this rigid steel lining. Convenience and economy, together with saving in shoring, result from the small-sized sections and the rigid continuity secured by bolting these sections together. The entire construction is speeded because of the simplicity in using plates and the fact that the tunnelers can keep in advance of the construction forces.

The Truscon Steel Co. has unusual facilities for making Steel Tunnel Liner Plates, as well as a wide variety of steel forms. Our equipment of presses is large and our shops for die-making unexcelled. When figuring your next sewer job get in touch with us and let us quote you prices on Truscon Forms and Truscon Liner Plates.

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PUBLIC WORKS.

CITY **COUNTY** **STATE**

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Vol. 51 **JULY 9, 1921** **No. 2**

Hetch-Hetchy Aqueduct Tunnel

Excavating, timbering and mucking in 10-foot 3-inch rock tunnel 18 miles Long. Construction from four portals and two shafts.

The Hetch-Hetchy reservoir in the Sierra Nevada mountains, in the valley of the Tuolumne river, 150 miles from the city of San Francisco, will impound 112 billion gallons of water to furnish daily supply of four hundred million gallons to the city and eventually to develop more than 280,000 h. p. of hydro-electric energy, utilizing only a fraction of the potential power due to the hydraulic head of about 3,600 feet between the dam and the city.

About twelve miles below the dam, at an elevation of 3,350 feet above the city, the water enters an aqueduct tunnel 18 miles long, which passes under two lofty mountain peaks in two sections about 4½ and 13½ miles long, separated only by a very narrow valley between the peaks. The tunnel, which is driven through rock, has a horseshoe shape cross section 10 feet 3 inches high and 10 feet 3 inches wide, is lined with concrete of a minimum thickness of 6 inches, has a cross sectional area of 87.94 square feet, and is designed to carry 400,-700,000 gallons of water daily at a velocity of 7.15 feet per second.

EAST SIDE SOUTH FORK PORTAL

The neat line encloses a cross sectional area of 105.63 square feet, for which amount of excavation payment is made, amounting to 3.91 cubic yards per lineal foot of tunnel, with corresponding allowance of 0.655 yards of concrete lining, no payment being allowed for quantities outside the neat line. The hydraulic radius is 2.60 feet and the hydraulic gradient is 0.00125. The coefficient of roughness in the Chezy formula is assumed to be 0.014, and the constant g to be 125.5.

Where timbering is required, it is shown in the drawings as permanent 8-segment bents, clear outside of the neat line, and provided, where necessary, with permanent lagging.

Excavation of the short section of the tunnel is proceeding at the headings from the two portals only, because the depth of the tunnel below the surface of the mountain is too great for intermediate shafts. The longer section is under construction from the portals and from two shafts.

The rock encountered is very hard granodionite, schist or quartzite, requiring about 30 pounds of dynamite per lineal foot of tunnel. Full size headings are driven with 18 to 24 holes, charged with 70 to 100 pounds of 60 to 80 per cent dynamite, and making an advance of about 5 feet per round.

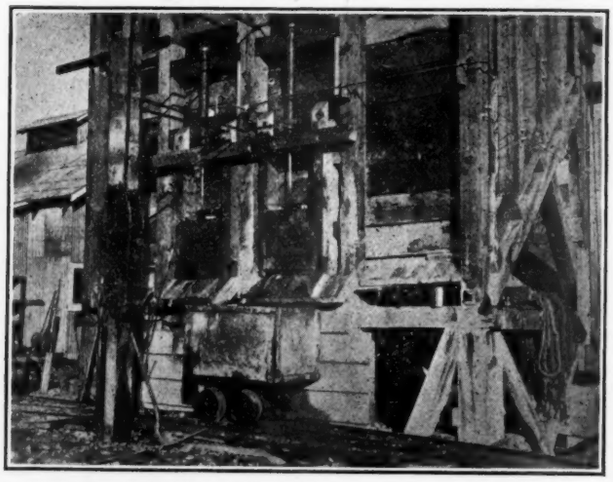
Abundance of standard plant has been installed, including motor-driven Laidlaw feather-valve compressors; rotary blowers with 20-inch air pipes; storage battery locomotives with charging apparatus; side dump, roller bearing tunnel cars; Water-Leyner, Sullivan and Waugh rock drills, and a Myers-Whaley mucking machine. The last is of sturdy construction with a very heavy bucket mounted on arms with both circular and straight line motions that enable it to simulate the operations of hand shoveling, the bucket first being crowded into the muck, then lifted, then moved backwards over the top of the machine and reversed, emptying into a short conveyor, which in turn discharges into the dump car at the rear. The machines are reported to effect considerable economy in handling the muck besides expediting the work by doing it much more rapidly than could be done by hand.

WEST SIDE SOUTH FORK PORTAL

Big Creek shaft, 575 feet deep to tunnel grade, has been extended 71 feet more to a total depth of 646 feet to provide for a sump and a dumping pocket where the muck is loaded by gravity from the tunnel cars to the hoists. Also a rock chamber has been excavated at tunnel grade alongside the shaft, to provide storage for equipment. Duplicate installations of double-drum, motor-driven, reversible hoists were installed at this and at the other shaft to provide for simultaneous workings from both headings. At the Big Creek shaft a heavy flow of ground water was encounterd 300 feet below the surface and was collected in a sump at a depth of 330 feet. Water entering below this level is separately collected in the lower sump and pumped the full length of the shaft.

The muck hoisted from the shaft is dumped into elevated storage bins with inclined bottoms and vertical sliding gates operated by pneumatic cylinders to deliver the muck to dump cars on the surface track.

The work is being executed under the direction of M. M. O'Shaughnessy, city engineer of San Francisco.



MUCK BINS WITH COMPRESSED AIR GATES AT BIG CREEK SHAFT

Increased Highway Construction in New York

Since January 1 the New York State Highway Department has let ninety-seven contracts for the construction of 387 miles of state controlled highways which will keep more than 7,000 men employed and represent a total cost of about $14,883,000. About 140 miles of road already have been finished, seventy-three of which are concrete 18 feet or more in width, thirty-five bituminous macadam and the remaining consist of other types.

It is planned ultimately to have approximately 11,000 miles of improved highways in this state, of which about 8,000 miles are now in existence. It is intended to complete the remaining 3,000 in six years. At present plenty of labor is available that is more efficient than for the last few years and can be hired, in some places, for 30 or 40 per cent less than last year.

Does State or Municipal Ownership and Operation Pay?

By Frederic I. Winslow*

An answer in the affirmative as shown in the experience of the Metropolitan District Commission of Massachusetts in the operation for ten years of two hydro-electric plants.

When the Wachusett dam at Clinton, Mass., was designed in 1895, there was planned a hydro-electric plant to be operated with the water sent to Boston, supplying that city and seventeen other municipalities. As this water is all sent through the older Sudbury system, there was also planned some years later to be installed at the Sudbury dam, a second power plant so that all the water would be twice used for power. The second plant was built 19 years after the gate-house in which it was installed, and some very careful work had to be done to fit the machinery to the existing conditions.

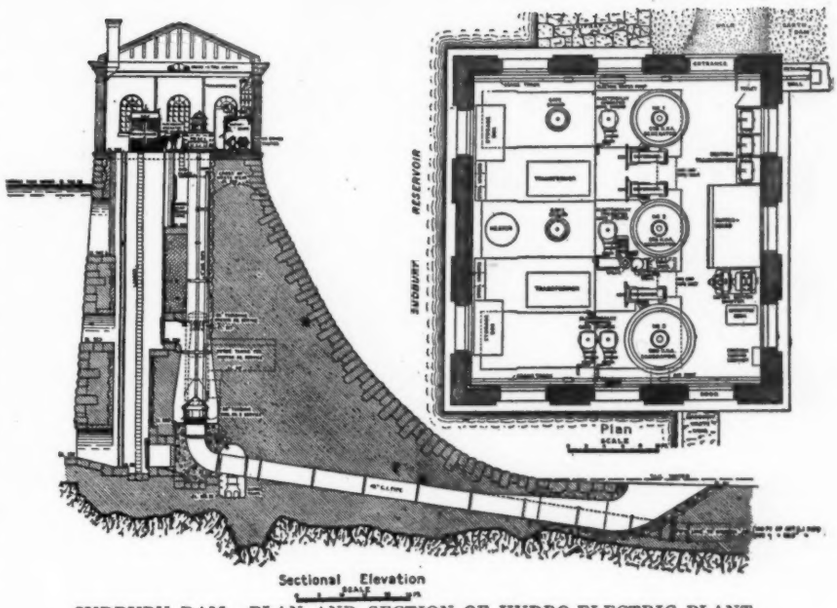
The total amount of water now used daily naturally varies from week to week, but is about 127,000,000 gallons per day. The fall utilized at Clinton is about 96 feet, and at Sudbury dam, two falls of about 36 and 65 feet are utilized.

As is well known in water works practice, the loss of head between the source of supply and the point of final consumption is almost unavoidable, and is a cause of considerable anxiety to engineers. In this case the loss between the Wachu-

*Division and Consulting Engineer, Framingham, Mass.

sett reservoir at high water and Chestnut Hill, where the water reaches the pumps, is 260 feet. The Roman engineers overcame this difficulty by building their aqueducts at a straight grade, involving high structures across valleys and involving enormous expense, which would be prohibitory in these days. Of course the Romans also lacked the knowledge necessary to cast large pipes to cross valleys under a head, so that they had no alternative.

At the Wachusett dam the larger plant of the two was built and put in operation in 1911. It consists of four 1,200 h. p. hydraulic turbine units, of the spiral case, horizontal shaft type, each directly coupled to a 1,000 kilowatt, 60 cycle, three phase, 13,800 volt, alternating current generator, to be used in exciting the main generator. The cost of this plant, including four Venturi meters, was $123,100.48.

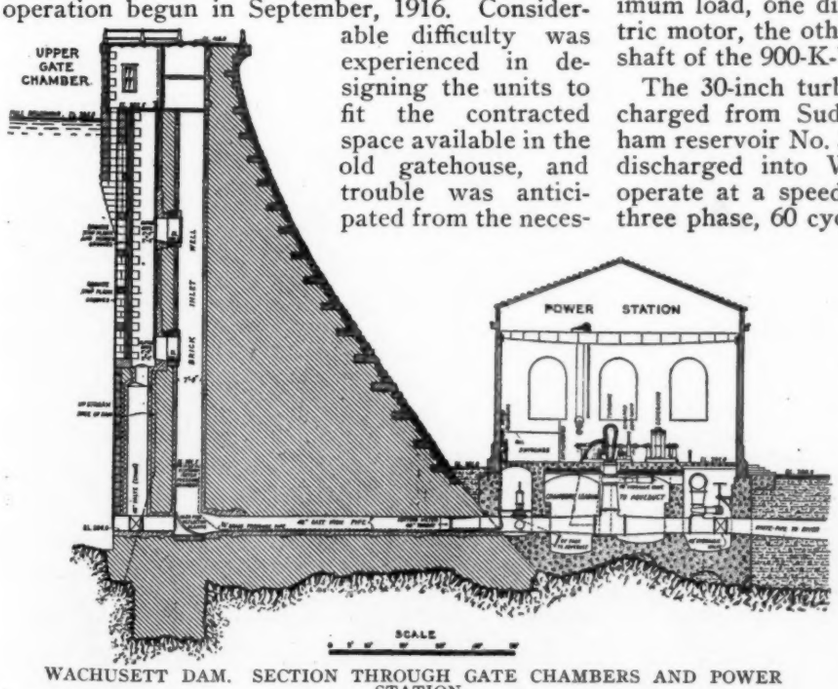


SUDBURY DAM. PLAN AND SECTION OF HYDRO-ELECTRIC PLANT

The receipts and earnings from this plant have been as follows:

Year	Receipts	Maintenance	Profit	Days Run
1912	30465.66	8995.66	21470.00	261
1913	33096.27	8989.75	24106.52	276
1914	38004.69	8969.46	29035.23	286
1915	26252.29	8125.47	18126.82	241
1916	34231.63	14633.72	19597.91	297
1917	37269.46	16948.98	20320.48	299
1918	44145.25	20522.49	23623.76	298
1919	40491.12	24162.36	16328.76	279
1920	51390.23	27778.14	23612.09	289

The plant at the Sudbury dam was finished and operation begun in September, 1916. Considerable difficulty was experienced in designing the units to fit the contracted space available in the old gatehouse, and trouble was anticipated from the necessity of discharging water from the wheels through long pipes at a high velocity, and the manufacturers refused on this account to furnish any guarantee of efficiency of wheels in place, and all invitations for bids on this basis were withdrawn and were later received under revised plans and specifications.



WACHUSETT DAM. SECTION THROUGH GATE CHAMBERS AND POWER STATION

This plant consists of one 30-inch 1,000 h. p., and two 24-inch, 300 h. p. vertical shaft, hydraulic turbines, directly connected to one 900-kilo-volt-ampere and two 275-kilo-volt-ampere alternating current generators.

Two 125-volt direct current generators are installed, each of sufficient capacity to furnish excitation for the three main generators under maximum load, one directly connected with an electric motor, the other directly connected to top of shaft of the 900-K-V-A generator.

The 30-inch turbine is operated by water discharged from Sudbury reservoir into Framingham reservoir No. 3 and the two 24-inch by water discharged into Weston aqueduct. The units operate at a speed of 360 R. P. M. and deliver three phase, 60 cycle, A. C. at pressure of 13,200 volts, to be stepped up by two 750-K-V-A transformers to 13,200 volts for transmission. The cost of this plant was $100,881.52, and it is usually run 15½ hours four or five days a week, and 24 hours the other days, not being run on Sundays or hoidays, except in some extraordinary emergency.

The energy is sold at a price fixed with the understanding that the service is not continuous, and may be interrupted as required to conserve the water supply, or to maintain the water ser-

vice into the Metropolitan District. The price at present obtained from the Edison Electric & Illuminating Company under a ten-year contract is $6.25 per 1,000 K. W.

The annual receipts and earnings from this plant have been as follows:

Year	Receipts	Maintenance	Profit	Days Run
1916	6663.21	3602.53	3060.68	90
From Sept. 14				
1917	18581.26			
1917	30962.47	18581.26	12111.21	304
1918	36125.39	19713.55	16411.84	315
1919	32736.59	17272.33	15464.26	303
1920	39892.71	19741.66	20151.03	305

The average earnings from both plants now is over $36,000 net. All figures include a proper allowance for depreciation and overhead expense. It should be, moreover, borne in mind that in both plants no men are kept excepting those absolutely needed.

The Philadelphia-Camden Bridge Over the Delaware

The state of New Jersey is engaged in two projects for carrying traffic across its river boundaries, from Jersey City under the Hudson river to New York at the northern end of the state, and from Camden to Philadelphia over the Delaware river in the southern part.

For the Camden-Philadelphia bridge the engineers' designs show a suspension bridge of 1,750 feet span, the longest ever built and estimated to cost nearly $29,000,000. It will have a capacity for six lines of vehicular traffic and four lines of rail traffic, the vehicular roadway being 57 feet wide and the total width of the bridge 125½ feet. The total live load provided for is 11,990 pounds per lineal foot. The clearance of the span above mean low water will be 135 feet and the height of the pylons 380 feet. It is hoped to have the bridge completed by July 4, 1926, the sesqui-centennial of the Declaration of Independence. The engineers selected as the Philadelphia terminus 6th street, between Race and Vine.

The double-track roadway will provide for pedestrian, motor and horse-drawn vehicles, railroads and trolley cars; the rail and trolley services being provided with spaces at each side of the lower roadway, while pedestrian promenades are located at each side of the upper roadway.

The engineers selected the suspension rather than the cantilever type largely because the former required a much smaller amount of metal —33,000 tons as against 47,000 tons. This saving was to some extent offset by a greater cost of anchorage structures for the suspension type but a balance of all arguments favored that type.

In planning the roadway widths, allowance of 9 feet 6 inches was made for motor trucks and six lines of traffic are provided for. The pedestrian promenades are each 10 feet wide. Two sets of tracks are provided for shuttle service across the bridge and two additional tracks for high-speed rail service. The approaches will be constructed on masonry supports, the space beneath offering possible opportunities for revenue-producing structures.

The towers supporting the cables will be of steel 16 feet wide at the top and 40 feet at the base. Each anchorage will require 90,700 cubic yards of masonry. The anchorages will embody the principal architectural features of the design. In order to insure an appearance of stability unaffected by elements, granite has been selected for the facing of the anchorages, the body of which will be of monolithic concrete, and reinforced concrete will be used for the roadway slab.

The board of engineers on the bridge design consisted of Ralph Modjeski, George S. Webster and Laurence A. Ball.

Fall Letting of Highway Contracts

A letter has been written by Stanley D. Moore, of the Moore-Young Construction Company, of Waterloo, Ia., to W. R. Neel, state highway engineer of Georgia and chairman of the Conference Committee of the American Association of State Highway Officials, urging the letting of contracts for highways in the fall rather than in the spring.

Mr. Moore classifies his reasons for this under six heads: (1) The greater abundance of open-top cars during the few months immediately preceding spring. (2) The closing of contracts in the fall would enable the contractor to perfect his organization and arrange for his storage and unloading during the idle winter months, thus permitting the early movement of aggregate during March, April, May and June, before the coal starts. (3) The same argument applies to moving cement and contractors' equipment in box cars before the grain movement begins. (4) Avoidance of the necessity of maintaining expensive lobbies and committees in Washington trying to get preferential rulings from the Interstate Commerce Commission, spreading the peak load and thus removing the fundamental cause of the trouble. (5) Any policy that will tend to increase the number of days during which a contractor can operate will enable him to spread his fixed overhead over a greater production and thus lower unit costs. (6) Low cost of roads can be obtained only by increasing production, and anything that increases the output per unit and spreads production over a longer period of time each year will result in decreased cost of cement, aggregate, transportation, and contractors' and supervising services.

In conclusion, Mr. Moore asks suggestions as to how to get the idea before the necessary authorities in time to get it into partial operation before next year.

The carrying out of this plan will involve the education of many people and legislative as well as executive bodies. For instance, legislators, budget committees, etc., must make their appropriations far enough in advance to permit definite plans to be made during the summer for the work of the year following so that these plans may be completed before the October letting. There is also the difficulty that these plans would ordinarily need to be completed during the season of the year when the engineering force of the highway department is most busy in its construction work, and would leave the force with little to do during the winter months after construction has ceased. However, there is in almost every state

an abundance of work that has already been planned and for which, in many of the states, appropriations are already available, and if such work were let, as suggested, in September and October, it would greatly relieve the situation even if the remaining work were held over until early spring.

Refuse Disposal Contract for Boston

Principal features of a very complete contract for disposing of the garbage and rubbish of that city for a ten-year term.

As was noted some time ago in PUBLIC WORKS, the contractor for disposing of the municipal waste of Boston has stated that he is losing a large amount of money in carrying out his present contract, but apparently has concluded to carry it out until next July, when it expires. The city is about to advertise for bids for another contract beginning July 1, 1922, and continuing for a term of ten years.

Bidders are asked to submit, on September 6, bids for disposing of garbage alone, refuse alone, or both garbage and refuse. A bond will be required of $60,000 in connection with a contract for either garbage or refuse and of $100,000 for both. Bids submitted must be accompanied by a certified check for 10 per cent of this amount.

Garbage, for the purpose of this contract, is defined as including "animal or vegetable matter or the refuse thereof that has been used or intended for food, together with paper contaminated by food products, shells, tins, bottles, jars and other food containers; and refuse shall include the material removed from catch basins, street sweepings, grass, garden refuse and leaves, ashes, waste paper, cardboard, string, packing materials, sticks, rags, waste leather and rubber, boxes, barrels, broken furniture and other similar light or combustible refuse, tins, bottles, jars, broken glass, broken crockery, bones, shells, waste or broken metals, and all other similar heavy or incombustible refuse."

The garbage to be dealt with includes that from districts No. 1 to 6, inclusive, and the refuse that from districts No. 1, 3, 4 and 5. The city will deliver garbage to the contractor at three wharves. Refuse will be delivered at two wharves, or at a dump or dumps to be furnished by the contractor not more than ¾ of a mile from one of the wharves.

In the specifications the city endeavors to protect itself from various difficulties and from any suits by the contractor by stating definitely that it "does not represent itself to be the owner of the garbage or refuse, and it is understood that any independent disposal of garbage or refuse by the producers thereof shall neither make the city liable to the contractor nor be held to justify his default in fulfilling any of the requirements of the contract.

"The city reserves the right to dispose of any part or all refuse, from any district or districts covered by this contract, in any manner which it may elect other than by delivery to the contractor, and the contractor shall not hold the city liable for loss due to non-delivery of said refuse. Neither shall the city make any deductions from the contract price because of a reduction of the amount of refuse delivered to the contractor for disposal.

"The city shall have the right to dispose of refuse collected by it at any dump controlled directly or indirectly by the contractor, whether said refuse is collected within or without any district or districts covered by this contract."

Where a contractor for refuse disposal purposes to obtain an income from certain parts of the refuse, such as fat from the garbage or saleable material from the rubbish, complaint has frequently been made by such contractor that private individuals are allowed to collect the garbage richest in fats, thus depriving him of a prospective profit. In other cases, metals and other saleable materials may be held back from the rubbish. Or if the garbage is being fed to hogs, it is necessary that a certain minimum amount be collected every day in order to furnish a regular amount of food for the hogs, otherwise a substitute for the deficiency must be purchased. The contractor therefore would seem to have a just cause of complaint when his anticipated source of revenue in the refuse is thus diminished, but according to these specifications, the city of Boston will not hold itself responsible in any such event.

"For information and inspection of bidders, a copy of the report made by Messrs. Patterson, Teele and Dennis, auditors and accountants, covering the operations of the Boston Development and Sanitary Company for the disposal of garbage and refuse from January 1, 1913, to August 31, 1920, will be on file at room 508, City Hall Annex, Boston."

Bidders are asked to submit a lump sum price per year for a ten-year term, payments to be made monthly. The plant and equipment for final disposition must be tested and ready for operation not later than July 1, 1922; except that if the contractor intends to utilize the land, wharves, buildings, etc., on Spectacle island, where the plant of the present contractor is located, it will be necessary for him to provide some other method of disposal satisfactory to the commissioner for the time (not exceeding 6 months) which will be required for removing the machinery of the present contractor and installing his own.

Another important condition of the contract is the following: "The city reserves the right at any time during the life of the contract to discontinue stations or to provide other or additional stations. The city also reserves the right to deliver the garbage to the contractor, in whole or in part, in sealed metal receptacles, provided by the city, said receptacles to be taken to the disposal plant by the contractor without opening

until their arrival at the plant. These receptacles must be cleaned by the contractor and returned promptly to the city. Failing agreement between the commissioner and the contractor as to any question of damage or increased cost alleged as being caused by such abandoned, substituted or added stations, or by the use of said receptacles, the matter shall be referred to arbitrators as hereinafter provided."

Certain other features of the contract are that the contractor must employ by preference citizens of Boston, next those of Massachusetts and third those of the United States; that he shall not require any employees to "lodge, board or trade at a particular place or with a particular person"; and that he shall discharge any employee who appears to the commissioner to be disorderly, careless or incompetent.

The specifications are unusually complete, covering the erection, equipment, maintenance and operation of the plant, vehicles, etc., necessary for transporting and disposing of the garbage and rubbish by whatever method may be selected by the contractor. Quite a full abstract of these will be given next week, as space is not available in this issue.

Trouble With Crustacea Organism on Filter Beds

By Helman Rosenthal*

Flea-like organism that swarmed in countless number killed by dosing the water with chlorine before filtration.

The Dallas, Texas, water purification plant receives its water from either of two sources. Elm Fork of the Trinity river is the more common one. But during the last two years we have received about 40 per cent of our raw water from Bachman's Lake, an artificial reservoir holding about 700,000,000 gallons of water. The water from this reservoir, which comes from natural springs and a small drainage area, is nearly always clear. Its turbidity for a long time is liable to be only one part per million. It is comparatively hard, about 150 parts per million, mostly bicarbonate alkalinity. This water is easily treated. However, at times this water carries a small flea about one-thirty-second of an inch long, and although the raw water has only a few, the water reaching the filters is at times full of them. They multiply very rapidly, and at times become so thick as to actually interfere with filtration. Washing the filters is only a temporary relief. At times they even work their way through the filters.

A study of the organism under the microscope showed the following characteristics. It is a long organism which swims on its belly. It has a very active tail, which moves up and down at "high speed." It has long legs, those in front are as long as the body. These legs have very definite joints, about 15 to 18. These legs have small branches like thorns on a rose twig. This flea seems to accomplish most of the swimming with these legs and tail. It has a sort of opal looking eye, which at times seems to be of a ruby red color. It has about eight legs, which resemble fins of a fish. When the drop in which the examination was made was almost gone by evaporation, the organism put up an awful struggle, and part of its head, which, by the way, is very defined, turned blood red, as if wounded.

Its tail somewhat resembles that of a fish, the part nearest the body is one narrow unit and it becomes fan shaped with about 10 or 12 ribs. It has a sort of elongated transparent protoplasmic movement from head to tail which terminates in a yellowish brown sack.

Some of these animalculae, which I presume are the females, have a sack hanging right under the tail. This sack contains about a dozen pea shaped cells. Each of these seem to have myriads of nucleii in them. Upon breaking up some of these cells innumerable nucleii spread in all directions. It is undoubtedly a crustacea organism and is similar, or perhaps the same as the Diaptomus Copepoda.

As stated previously, this organism at times becomes a real nuisance, and a method had to be devised to rid the filters of the pest. $CuSO_4$ suggested itself, but its use was somewhat expensive, nor was it very desirable. Finally the writer hit on an idea of chlorinating the water just before it goes to the filters.† The writer figured that the experiment was both harmless and inexpensive. We used from 0.5 to 0.7 parts per million of liquid chlorine. About three hours later samples of water from the filters showed the total absence of these organisms.

The writer feared that the strong chlorine solution might harm the biological activity going on within the filters, but the bacterial reduction showed that the fear was groundless.

The total expense was very small indeed, considerably less than copper sulfate would have cost and, of course, not in the least objectionable.

*Superintendent and Chief Chemist, Dallas Water Purification Plant. Paper before American Water Works Association.

†We always chlorinate the water after filtration, using about 0.2 to 0.4 parts per million of liquid chlorine.

Shade Trees for Pennsylvania Highways

The State Highway Department of Pennsylvania began in June planting a large number of American elms and sugar maples along the state highway between Gettysburg and Harrisburg. The work is being done under the direction of the State Forestry Department.

State Highway Commissioner Sadler said that it is the aim of the department eventually to beautify all the main highway routes in Pennsylvania through the intelligent planting of shade trees. A plan has been worked out with the aid of the forestry department whereby a comprehensive system of planting trees along state high-

ways will be taken up. The highway commissioner having designated the highway to be planted, the commissioner of forestry will inspect the highway, recommend the species to be planted and give in detail the planting operations, such as distance, care of stock, size and depth of holes, setting of the trees, fertilizers, staking trees, planting crew, necessary tools, approximate time required, and other details. State foresters will direct operations and inspect the trees from time to time.

In order to make a success of this work it will be necessary to obtain the hearty co-operation of the adjacent land-owners, obtaining their permission to remove undesirable trees along the highways if these are four inches or more in diameter at two feet above the ground. It will also be necessary to obtain the co-operation of companies operating overhead service lines. The trees will be furnished by the forestry department as rapidly as they become available from the state nursery.

Colloids in Tank Treatment of Sewage

At the convention of the American Water Works Association a paper was read before the chemical section by F. W. Mohlman and Langdon Pearse, chemist and sanitary engineer, respectively, of the sanitary district of Chicago, entitled "Colloid Chemistry and Its Relation to the Tank Treatment of Sewage." The authors state that within the last two or three years improved methods of study have been developed, and new processes of sewage treatment, such as the activated sludge and the Miles acid process, have had striking effect upon colloids in sewage. The purpose of the paper was to summarize the work that has been done and offer suggestions.

They stated that when activated sludge is in its best condition it will remove practically all the colloids from the sewage, but when underaerated apparently not all colloids are removed, and when over-aerated the sludge is more finely dispersed and is returned to colloidal condition in the effluent.

They describe the various methods suggested for the determination of the amount of colloids in a liquid, and call attention to the importance of developing some standard method.

Only a few experiments have been made on removing colloidal matter by tank treatment. Colloids will practically pass through and out of a tank within the usual flow periods of two to four hours employed in the settling chambers of Imhoff tanks. In the Travis tank an attempt was made to coagulate the colloids on the surfaces of colloiders or slats hung in the settling chamber spaced about three inches apart transversely and five to nine inches longitudinally. In the use of the Miles process or other application of acid to sewage, it is thought probable that the acids, which carry a positive electric charge due to hydrogen ions, neutralize the negative charges which the colloids are believed to carry and thus coagulate the colloids.

It is suggested that coagulation of colloids may also be effected by biological agencies, it being possible that in the activated sludge process enzymes have a clotting effect. Among the experiments by the Sanitary District was a so-called biolytic tank, in which all incoming sewage passed upward through the accumulation of sludge. Although septic action prevailed, with constant generation of hydrogen sulphide, a marked clarification resulted.

"Interesting developments may be hoped for in the application of methods of colloid chemical research to the problem of dewatering sewage sludges. For example, we do not know why fresh sewage sludge is so retentive of its water, while digested sludge parts with it so much more easily. The moisture content of Imhoff sludge varies widely with different sewages, and many problems in its digestion are still unsolved."

In conclusion, the authors believe that: "It is apparent that we are in need of: 1. A standard definition of the limits of size of colloids in sewage. 2. A standard method for the determination of sewage colloids. 3. The study of the effect of the hydrogen ion concentration on the removal of colloids, correlated with other determinations and observations which will prove the validity of such pH determination. 4. Tests of the practical application of precipitants which have been found effective in laboratory experiments. 5. Investigation of the principle governing the retention of moisture by sewage sludge.

Hamilton County Paving Plans

Hamilton county, Tennessee, by the middle of June had forces laying concrete pavement at the rate of about 500 feet a day. The policy of the present county administration is to add 10 miles of concrete highway each year if possible. This year's work is costing the county about $35,000 a mile. Of the cost of these county roads the state pays one-third and the federal government one-third. Hamilton county assumes responsibility for the remaining third, but expects to meet this without the expenditure of much cash except that required for purchasing equipment, the rental of which equipment will be credited to the county on the construction account. The county will also be credited with the convicts used on the work. Only about 30 free laborers are employed on the work, these being engaged as operators of steam cranes, concrete mixers, pumping plants, etc., and for placing the concrete forms and driving trucks. Machinery is used as far as possible, the mixers being fed by machinery and no wheelbarrows being used. The trucks receive the sand and gravel in the correct proportions and dump directly into the skip.

The pavement being built is one-course, plain concrete slab of 1:2:3 mixture, the coarse aggregate being Tennessee river gravel. The pavement is 16 feet wide with a 3-foot chert shoulder on each side, the concrete being 6 inches thick at

the edges and 7½ inches at the center. Except at a few places where maximum grade of 6 per cent is reached, the grades run well under 2 per cent. No drainage structures worthy of mention are found on the entire right-of-way and many of the existing steel bridges will be used.

Ventilating the New York-New Jersey Tunnel

One of the weighty problems connected with the projected tunnel between New York City and Jersey City which has not been solved satisfactorily to all concerned was that of ventilation. It was felt that the passing of thousands of automobiles through the tunnel would make especially difficult the problem of keeping the air in the tunnel sufficiently pure for comfort and health. Investigations in ventilation have been carried on in the Pittsburgh district where a coal mine had been fitted up to duplicate as far as possible the tunnel conditions. Also a model of the tunnel is being prepared at the University of Illinois, with the ventilation apparatus installed. The chief engineer, Clifford M. Holland, stated recently that the results so far have proved "that we were over pessimistic in our tentative conclusions as to ventilation. No shadow of doubt now remains that we shall be able effectively to ventilate the tunnel with one-half the horsepower we had figured as required, pumping into the tunnel 3,500,000 cubic feet of air a minute and completely changing the atmosphere in the tunnel forty-two times an hour."

Applications for Positions

By Clarence D. Pollock

This is the season of the year when many applications for positions are received from young engineering graduates.

Judging from the character of many of them it would seem desirable that the engineering colleges give some instruction in this matter. The following is an example picked from a number of similar applications recently received which do not create very favorable first impressions:

I wish to apply for a position in your company. I graduated from a reputable college and have had a large amount of study in all kinds of engineering and am therefore qualified for any position where I can use my engineering. I have had large experience with some very large concerns and would like a position in your office.

Many of these applications are less concise than this one, often repeating the same statements in several ways without telling any more about the candidate than does the above. If he had given the name of the "reputable college," the year in which he graduated, the titles of the positions he had held, the length of employment and names of the "very large concerns" for which he had worked, he would create a much more favorable impression.

The natural inference is that a man who submits an application in such general terms will require a great deal of training before he will be of much use. If he is sent out on inspection he is not likely to use much judgment as to what are the more important features and his reports will be too general and indefinite to be of any value.

Business schools and stenographic schools give instruction in the writing of applications for positions and it would seem desirable for engineering schools to do the same. Many times the applicant is a capable man, but through lack of a little instruction fails to think how the recipient of the application will have only his letter by which to judge of the candidate and if his letter tells him nothing besides the fact that he wants a job, he is likely to be passed by for some one who tells more about himself in his letter.

It is important for the candidate to make a good first impression by writing a concise letter which really tells something definite about himself and his qualifications.

Mortar Beds for Block Pavements

Editor, Public Works,
New York City.

Dear Sir: I have been very much interested in Mr. Howell's article on repairing Broad street pavement in Newark, and also in your editorial on the value of a mortar bed in block pavement. I can add to the information on this subject to the extent that we have found mortar beds in St. Louis, under both wood block and brick, which were later found to be of no more value than a sand cushion. We have also found mortar beds several years old which are almost as hard as the concrete base, and this applies to work adjacent to street car tracks as well as streets without tracks. During the past year I have made a very careful examination of mortar beds during and immediately after laying, and have reached the conclusion that the defective mortar beds were those which were laid with sand sufficiently damp to start up the setting of the cement immediately after mixing, and that a hard set had taken place before the street was rolled, but that the mortar bed was so weak at the time of rolling as to be completely broken up by the action of the roller. It has always been our custom in St. Louis to make the mortar bed dry and to sprinkle it *after* the rolling is completed. In analyzing our results I find that the strongest mortar beds were those which were laid in midsummer where the sand had been stored on the pavement in the sun, and was completely dry when mixed with the cement. Our most noticeable failures have been on work laid in the late fall when everything was wet. I am now requiring on sand-cement bedding courses that the sand must be reasonably dry when mixed with cement, and that, where possible, not more than an hour shall elapse between the mixing of the mortar bed and the rolling of the particular section of pavement. This, of course, requires that rolling work be kept up very close to the pavers.

Very truly yours,
W. W. Horner,
Chief Engineer, Sewers and Paving, City of St. Louis.

Philadelphia's Sewage Plant Dispute

Some time ago Philadelphia contracted with the Philadelphia Subway Construction Company to build what is known as the Northeast sewage disposal plant, the contract price being $1,025,000. More than a year ago the contractor gave up the contract and the city called upon the National Surety Company, its bondsman, to complete the work. This it refused to do and was placed on the blacklist by the city. Last December a proposition was before the council to pay the company an additional $350,000 for completing the work, in view of the higher cost of materials and labor. Later it was proposed that, in view of falling prices, this sum be cut to $275,000. A few days ago a joint committee reported to the council favoring the payment of the latter sum for the completion of the work.

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State Co-operation in River Control

In certain ways a river forms a convenient physical feature to serve as a boundary between states or other political areas, but in more ways watershed boundary lines or the summits of mountain ranges, where these exist, would serve the purpose better. For instance, if a river should flow through the center rather than form the boundary of a political area, the drainage of such area and the water supply would all be embraced within the political boundaries. With rivers as dividing lines between states, the authorities of such states find it necessary to agree upon united action or, as too often happens, appeal to federal courts for a definition or protection of their rights.

It is encouraging to note that co-operation rather than legal contest is being practiced by the governments of New York, New Jersey and Pennsylvania in most of their mutual relations with respect to water courses. Such is the agreement between Pennsylvania and New Jersey with a view to removing pollution from the Delaware river, and between Pennsylvania and New York with respect to the upper courses of the same river. Within a few days Governor Edwards, of New Jersey, announced his approval of a proposal by Governor Sproul, of Pennsylvania, for a conference of the governors of those two states and of New York to discuss flood control and the general economic importance of the rivers that affect these three states.

For Better Brick Pavements

"Too many construction jobs (of brick pavement) we have visited have displayed marked evidence of carelessness and lack of supervision and planning in the various operations involved. There has seemed to be lacking that interest, in all but a few notable instances, which results in good workmanship."

The Bureau of Public Roads began in the latter part of June taking photographs of actual construction of brick pavements with the purpose, we understand, of using this as part of an educational campaign for securing better highway construction. The Bureau has received the hearty co-operation of the National Paving Brick Manufacturers' Association, and its secretary, M. B. Greenough, has accompanied the representatives of the bureau for the purpose of selecting for photographing such work as would best serve as a model for showing how brick pavement should be laid. In Mr. Greenough's report to his association after a few days with the photographers, he makes the statement quoted above. As one item of faulty construction, he found "perfectly good brick going into a pavement with so much dirt stuck to them that no filler, either bituminous or cement, possibly could penetrate a joint."

From the organization of this association it has continually been one of the aims, and one greatly to its credit, to develop the best methods of constructing brick pavements and encourage the adoption of such methods. This, of course, is an intelligent effort towards benefiting the industry, since the best advertisement of paving brick is a good brick pavement.

It would appear from Mr. Greenough's remarks that too many engineers in charge of brick pavement construction are lax in securing a high or even reasonably good character of pavement construction, and Mr. Greenough can hardly be blamed for complaining that while "engineers have ever been ready to refine the product of the industry," "they have been singularly lacking in the share they could contribute to better brick pavements by enforcing good construction methods. From what we have seen, we should say that things are getting worse rather than better."

A good brick pavement requires something more than good brick; good construction can do as much to secure a perfect pavement and poor construction as much to produce an unsatisfactory one as can the furnishing of good or bad

brick or other material entering into the construction.

Instead of conditions as to construction being worse than formerly, they should be better. Owing to the effect of post-war conditions on the industry, the cost of paving brick delivered on the street has increased more than that of most other paving materials. Since brick have become so expensive, it certainly would seem to behoove every city, county or state and the engineers representing it to take greater pains than ever to use this expensive material so as to obtain to the full the value which it is capable of giving.

It is to be hoped that, when the association finds any brick paving being done improperly, it will explain the objectionable features to the engineer in charge and that the engineers will receive these criticisms in a spirit of co-operation and endeavor to eliminate improper methods and secure in each case the best pavement the material is capable of. This, of course, should be the aim in all engineering construction, including pavements of whatever material, and broad-minded engineers will receive with thanks any suggestions which will aid in securing this end.

Planning Mechanical Equipment for a Road Job*

By C. D. Curtis†

It is unfortunate, but nevertheless a fact, that most jobs are equipped without giving to their planning and organization a proper amount of careful study. As a result expected profits shrink and may even become actual losses. Improperly equipped jobs can be classified under three heads:

1. Too much plant,
2. Lack of plant, and
3. Unbalanced plant.

With too much plant on a job the efficiency of operation is lowered, and although fairly satisfactory progress may be made, the cost will be too high. Rental or interest on investment and depreciation charges continue regardless of output. On an under-equipped job it is necessary to resort to labor which may be less efficient and more expensive. The progress of the work is likely to be delayed and total costs increased.

Of all the improperly equipped jobs the ones that have an unbalanced plant are probably most common. They are the inevitable result of equipping without planning. The several units making up the plant may be efficient mechanically when considered alone, but totally incapable of being worked smoothly and continuously together. On such jobs efficient operation cannot be secured. The plant investment might, and probably would, be higher than for a balanced plant. The season's profits however, are certain to be lower than anticipated.

*Excerpt of paper presented at spring meeting of the American Society of Mechanical Engineers.

†Assistant to Chief, Bureau of Highway, United States Department of Agriculture.

CLASSIFICATION OF ROAD-BUILDING WORK

A classification of road-construction jobs based on the desirable and practicable rate of progress is feasible and would aid the contractor or engineer in selecting the proper plant. In determining on such a classification several factors would enter into the consideration, chief of which would be the size or length of the project. Another factor would be the problem of satisfactory detours and the probable economic loss to traffic. The cost, of course, would be affected by the classification. Ordinarily a higher rate of progress would be required on a large job than on a small one. The extra cost, then, of assembling and operating a large plant capable of rapid progress would be spread over a large yardage. It might easily happen, however, that the economic conditions would warrant requiring very rapid progress on a comparatively small job. This would change the classification and increase the cost of the work, but the bidder would know just what to expect.

In connection with concrete road jobs there might be three classes, such as:

A—Jobs on which equipment with a daily capacity of 1,000 feet of 18-foot roadway would be required.

B—Jobs on which equipment with a daily capacity of 500 feet of 18-foot roadway would be required.

C—Jobs on which equipment with a daily capacity of 250 feet of 18-foot roadway would be required.

In the case of Class A jobs it would ordinarily be desirable to equip with at least two complete operating units. This would insure continued, even though retarded, progress in the event of a breakdown of one unit.

Unnecessary refinements in the specifications which are met with at times usually lead to difficulties in operation and should, in the author's opinion, be avoided, especially where enforcement increases the cost of operation for minor or questionable benefits. There are, however, certain limitations which make necessary an intimate knowledge of the specifications under which work is to be performed. Examples of these limitations are:

1. Time limit on depositing of concrete after mixing. This limit would have a direct bearing on the location of central mixing plants and the equipment required for handling both the aggregate and the concrete.

2. Definite requirements relative to concrete mixers such as water-measuring devices, boom and bottom-dumping bucket, etc. Such requirements are small details, but must be met and so must be considered in selecting equipment.

3. Materials for concrete not allowed on subgrade. This feature is very important and makes necessary a careful study of the project in the field. Several alternative methods of handling the materials may be possible after a consideration of all the conditions.

SELECTING EQUIPMENT

In selecting equipment for a project, everything bearing on the situation should be considered.

The source of materials to be used, whether local or imported, condition of roads to be hauled over, width of available right of way, trackage and storage facilities available at receiving points for materials requiring rail transportation, maximum grades, water supply, availability of common labor and teams, and length of working season are some of the factors which should be looked into and studied before deciding on the type of plant to be used. In this connection the engineer may and should render all possible aid to the contractors. The preliminary investigations and detailed surveys made by the engineer give him much more information than the contractor can secure readily in his preliminary field inspection of the project. If the engineer knows that the conditions, even though not apparent, make the use of certain types of material impracticable, this information should be given to the contractor.

By arranging to ship and store materials during the season of light demand for open-top cars, for use during periods of car shortage, a continuous supply of materials can be secured. Such an arrangement may considerably alter the selection of equipment for handling the material. The extra cost of storing materials may be more than offset by the gain due to continuous operation during the construction season.

Where the materials can be unloaded from cars or loaded from the quarry or pit directly into containers for transportation to the job and in addition can be deposited in the mixer, in the case of concrete, without touching the ground, a great advantage is gained. In addition to being kept clean and free from mixture with foreign matter, the item of waste is very greatly reduced.

EXCLUSIVE DEVELOPMENT OF LARGE INDIVIDUAL UNITS UNDESIRABLE

In some states, by adopting the practice of letting large contracts for long stretches of construction work, large contracting companies have been induced to enter the highway field. They have brought trained operating organizations to the work and have put extensive road-building plants on their jobs. There is wisdom in such procedure whenever possible, for, of necessity, a great many road jobs are and will continue, for a variety of reasons, to be of comparatively short length. Letting contracts in both large and small sections gives both the small contractor and the large a field of operation and greatly expedites the carrying forward of a large program. The small contractor, acting as his own superintendent and operating with but little mechanical equipment, has but little overhead and can compete on a small job with the large contractor operating a large plant and carrying heavy overhead expenses.

Road building differs from most other construction activities in that the operations are conducted along an extended narrow path. The failure of one link may interrupt the work of a whole operating chain. This fact, in the author's opinion, makes the present tendency toward the development of large individual units somewhat questionable. When a large unit is used every precaution should be taken to insure its continuous operation.

IMPORTANCE OF MAINTAINING ORGANIZATION THE YEAR AROUND

One of the greatest handicaps which the road builder encounters in the northern states is the short construction season. Continuous operation is impossible and each season it is necessary to organize new construction forces. In the case of the skilled mechanics and foremen, an attempt should be made to retain their service the year around. They can be utilized during the winter in repairing equipment and putting it in first-class condition for the next season's work. The use of an extensive plant requires skilled operators, and, once trained, their services should be retained. Efficiency of operation in road work depends on the proper functioning of all the separate units. The mechanical units function properly only when properly handled.

On large jobs where more than one plant or complete operating unit is used, the spirit of the organization can be kept up by introducing friendly competition. The rivalry between two outfits to reduce costs and increase yardage has a very healthful effect on progress and incidentally on profits.

Cutting a 60-Inch Cast Iron Main With Oxyacetylene Torch

The proposed changes by the Baltimore Water Department in the distribution system at North avenue and Oak street required the removal of a 60 x 30-inch three-way and inserting of a 60 x 48-inch three-way and connections. As the operations of the Water Department were retarding the paving of the street, a method quicker than cutting the 60-inch cast iron pipe by hand labor was desired. An oxy-acetylene torch and operator were obtained through the local sales engineer of the Davis-Bournonville Company, and the cutting of the cast iron pipe was started immediately. The progress of the cut varied from .63 inch a minute to 1.3 inches a minute, the average being 0.7 inch a minute. The thickness of the cast iron pipe was 1.7 inches. Upon investigating the cut edges, small cracks were discovered around the entire circumference at intervals of 1.5 feet extending from ½ inch to 1½ inches from the face of the cut. This necessitated the removal of the pipe and the insertion of a new piece of 60-inch main. The new main was cut on the surface by hand labor, thus affording a direct comparison of the cutting of cast iron pipe by hand labor and with the oxy-acetylene torch. The following results were obtained. The cost of cutting the 60-inch pipe (2 cuts) by hand labor was $232.52, including labor, overhead, depreciation and the cost of sharpening the tools; whereas the cost of cutting the pipe (2 cuts) with the oxy-acetylene torch was $104.23, including labor, fuel consumed, depreciation and overhead, thus resulting in a saving of 55.2 per cent. The time saved was 62.1 per cent.

As the result of research work now being conducted by the engineers of the Davis-Bournonville Company it is possible that a practical way will be found for cutting cast iron pipe economically and quickly with the oxy-acetylene torch.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

How to Drive Wooden Piles—II*

Drophammers, towers, cantilever and turntable drivers, penetration, steam hammers, double-acting hammers.

Where the work justifies it, much more rapid and economical results will be obtained by the use of a drophammer weighing from 2,000 to 5,000 pounds, operated by a steam hoisting engine installed in a movable timber tower a few feet higher than the longest pile to be driven. The tower usually has two vertical front legs about 4 feet apart transversely and two rear legs that are battered about 1 to 3 in the same longitudinal planes; all four legs being thoroughly braced together and mounted on a horizontal platform about 4 feet wide and 15 or 20 feet long that is braced to the rear legs and equipped at the rear end with a 2-drum, 2-spool hoisting engine, boiler and fuel and water supply.

The platform has full length longitudinal sills generally mounted on several wooden rollers 6 to 12 inches in diameter and 10 to 20 feet in length, with holes in the ends by which they may be revolved by capstan bars, moving the tower backwards or forward on the timber track laid on the ground to command the line of piles. The bearing of the sills on the rollers is usually in concave blocks that permit the tower to be moved lengthwise of the rollers, thus making transverse displacement from one row of piles to the next. Ordinarily the tower is about 50 feet high and with the hoisting engine and boiler weighs about 15 tons and may be shipped in one or two sections on flat cars. Larger ones must be partly disassembled for shipment and smaller ones may be transported on one or two automobile trucks.

CANTILEVER AND TURNTABLE DRIVING TOWERS

For driving piles on trestle falsework, viaducts, piers and various other positions where there is a long series of transverse bents 10 to 18 feet apart longitudinally, very good results are obtained with the cantilever driving tower which has the vertical posts mounted at one extremity of a long platform mounted on wheels and overhanging them one panel length, while the rear is counterweighted by the hoisting engine, boiler and other equipment, thus enabling the machine to drive a bent of piles in advance of the track, lay the track on it, advance to the next position, and so on. Such pile drivers are rather elaborate and costly and are sometimes provided with a turntable device that enables them to swing from side to side, driving several piles in the same transverse row from one position.

The vertical posts of the driver are provided with steel faced guides on their inner surfaces that engage slots in the hammer and keep it aligned. For operation at a considerable elevation above the surface of the ground these guides, called "leads," are frequently provided at the lower end with a detachable extension 10 feet or more in length, enabling the hammer to fall and the top of the pile to be driven below the base of the machine.

INCLINED LEADS

For driving inclined piles various arrangements are provided for tilting the tower out of the vertical or for pivoting the leads at the top and swinging them loosely to the required angle. In either case the efficiency of the drophammer driving is rapidly reduced with the divergence from the vertical, since only the vertical component of the weight of the hammer is effective and considerable friction must be overcome besides.

The hoisting engine should be rigged with an extra strong 1¼-inch diameter manila hammer line and the other drum with a wire rope, both of them led through sheaves at the top of the tower, the wire rope being used to handle the piles in the leads. A 4 or 6-part tackle is also convenient for hauling the piles along the ground to the foot of the pile driver and lines operated by the spools of the hoisting engine are very convenient for pulling the latter forward, backward or transversely.

WEIGHT OF HAMMER AND HEIGHT OF BLOW

Drophammers usually weigh from 1,800 to 4,000 pounds with the average size close to the upper limit, say about 3,000-3,500 pounds. The average drop of the hammer is about 10 feet, permitting the mechanical energy to be absorbed for useful effect in driving the piles. If it is very much less than this amount the blows are weak, and if it is much greater the momentum and velocity, increasing directly with the height, soon become so great that they cannot be wholly ab-

*Part I, General conditions and requirements, number, size, penetration, refusal, capacity, calculation, tests, pointing, cutting, banding and horse power was published June 18.

sorbed in useful driving and are likely to damage the pile, therefore the ordinary upper and lower limits of the drop are about 15 feet and 2 feet, respectively, with a maximum upper limit of about 25 feet. Under no circumstances is even a light hammer allowed to drop the full height of tall leads on a pile head because from a height of 50 to 60 feet it would shatter the pile.

BLOWS AND PENETRATION

The average number of 10-foot blows of a drop-hammer vary from 15 to 20 per minute under favorable conditions, and a penetration of 30 feet may perhaps be produced in soft earth or clay by 60 blows, while 250 to 300 blows may be required for the same penetration in difficult material. The penetration, of course, varies between very wide limits, according to the nature of the soil, and may be entirely stopped by obstructions such as rocks, boulders, masonry, hardpan, old timbers and abandoned structures. Assuming that these do not exist but that the driving is free in a clear stratum, it is most rapid in mud, or silt, where a pile sometimes penetrates many feet under its own weight alone and then goes rapidly with gentle driving. In some cases if the penetration is rapid and continuous it may be several inches per blow at a depth of 60 or 70 feet and if discontinued for many hours the resistance from skin friction may be great enough to hold it immovable under heavy driving.

Most soil can be penetrated to considerable depth by judicious driving which must be varied according to the conditions. Sand and gravel are among the most difficult soils to penetrate and in order to penetrate 20 feet by hammer alone probably 600 blows would be required in coarse dry sand and much greater difficulty would be encountered in driving to a greater depth. The finer or wetter the sand the harder to drive through it.

STEAM HAMMERS

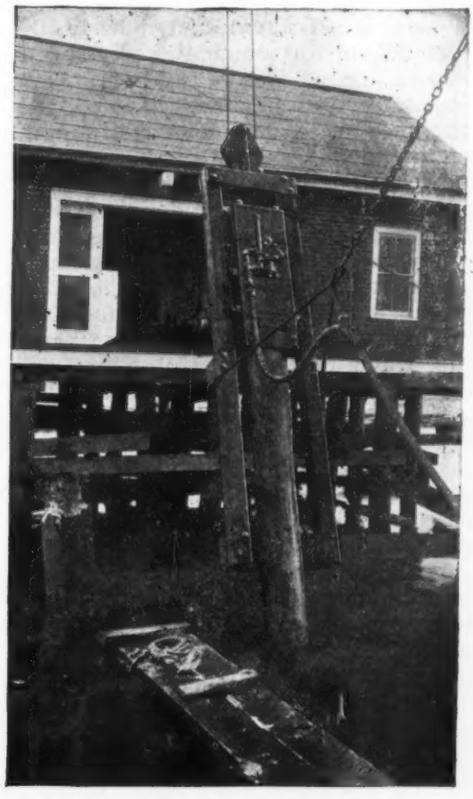
If a hammer is conveniently available or in any case if the driving is very heavy the use of a steam hammer, operated by steam or compressed air at a pressure of 100 pounds or more is very efficient and often enables piles to be driven and penetrations attained that are impossible with drophammers, chiefly because the very rapid action of the hammer keeps the pile in motion too continuously to prevent "set" and because the heavy load of the hammer continually imposed upon the pile facilitates driving.

Steam hammers are designed to fit directly on the head of the pile and may either be operated in the guides of an ordinary pile driver tower or may be handled by a derrick or any other convenient apparatus and seated directly upon the pile that is guided or otherwise held in position without guides, thus making it convenient to drive a large number of piles in a group with a hammer easily transferred from pile to pile after the latter are set in position. Often the hammer may be handled by a locomotive crane, by the boom of a stiff-leg or guyed derrick, which is likely to be necessary for other construction operations and thus obviates the necessity of providing a special pile driver tower.

The steam pile hammer is a steam cylinder and piston resting on the pile and delivering to it a blow with every stroke of the piston. In some makes the piston forms the hammer and in others the piston is stationary and the entire remainder of the machine serves as a hammer.

There are two principal types of steam pile hammers, the single-acting and double-acting. In the former the expansive force of the steam is used merely to lift the moving part that falls on the anvil with inertia due only to its own weight. In the latter the steam is admitted at both ends of the cylinder alternately, and not only lifts the

DRIVING PILES WITH DOUBLE ACTING McKIERNAN-TERRY STEAM HAMMER IN LEADS SUSPENDED FROM LONG DERRICK BOOM



DRIVING BATTER PILES WITH McKIERNAN-TERRY DOUBLE ACTING STEAM HAMMER

moving part, but drives it with full expansive force in addition to the weight of the falling body, thus producing more rapid and stronger action and using a larger quantity of steam.

The advantages claimed for single-acting hammers over double-acting hammers are the possibilities of somewhat fewer parts and greater simplicity, a reduced first cost, and a smaller consumption of steam power, which in the larger sizes may be only about 2/3 of that used by the double-acting hammers.

All the principal types of steam hammers are made in several sizes, of which the larger ones are chiefly intended for driving larger and longer piles, and for piles that penetrate very difficult soil. With the largest sizes of hammer of either type suitable piles can be driven to a great depth in any material, including hardpan and decomposed or soft rock. Steel piles have also been driven through large boulders which they split or have been driven until the lower end encountering an immovable obstruction has been deflected and forced upwards till it actually emerged above the surface of the ground.

Single-acting steam pile hammers weigh from 800 to 16,000 pounds, strike from 125 to 50 blows per minute and develop a variable foot-pound energy proportioned solely to the weight and length of stroke. The largest size is rated for a 40 h. p. steam boiler.

DOUBLE-ACTING HAMMERS

The double-acting pile hammer varies in weight from 145 pounds to 13,200 pounds, strikes from 500 to 140 blows per minute, and when supplied with steam at a pressure of 80 pounds per square inch, develops a maximum energy of 17,500 foot pound per stroke for which there is specified a 60 h. p. boiler.

Single-acting steam hammers have a lower cost and sometimes are of simpler construction than double-acting hammers and consume less steam or air power. The larger size requiring perhaps only about 2/3 as much as the double-acting hammers. They cannot drive piles when the latter are very much inclined from the vertical and they cannot be used for pulling piles. Double-acting hammers have smaller dimensions and are more compact than single-acting hammers, they strike more rapid and more powerful blows and can drive the piles through greater obstructions, can drive more linear feet of piles in a given time, can drive piles at any inclination with the same efficiency that they can drive vertical piles, and can be used with great efficiency for pulling piles. The larger the pile driven, the greater should be the weight of the hammer so as to overcome the inertia of the pile itself. A great advantage of all steam hammers is the minimum head room that they require, being able to operate in any place where they can be installed, and thus being efficient for working in and under buildings and in other restricted quarters.

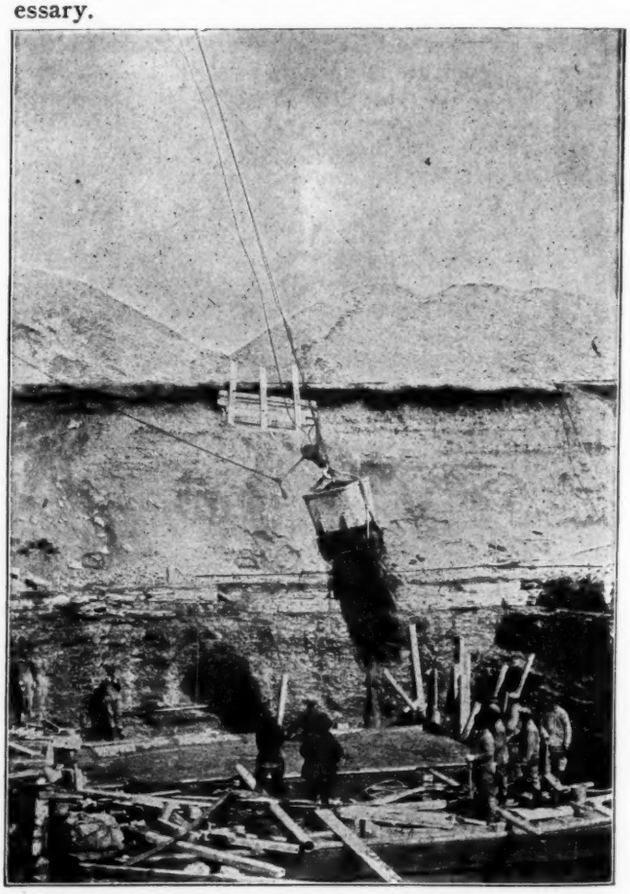
Lumber Production

According to a preliminary report of the United States Census Bureau the production of lumber in the United States was, in 1914, $715,310,000, and in 1919 it had increased to a valuation of $1,400,000,000. For the last ten years the production has decreased from 44,509,800 feet in 1909 about 22 per cent to 34,552,100 in 1919, when the production of yellow pine was 13,062,900, Douglas fir 5,902,200, oak 2,708,300 and Western yellow pine, hemlock and white pine each about 1,755,000 feet B. M. Since December, 1920, when the cost of lumber reached the highest peak at $37.27 it has declined 40 per cent.

A Skilful Derrickman

For the construction of the Lockington dam in the Miami Conservancy District, concrete was delivered to the forms in a bottom-flap steel bucket of 36 cubic feet capacity handled by a 105-foot boom steel derrick with a 120-foot mast.

In order to deposit the concrete at a point beyond the radius of the boom, the derrickman, Ed. Hines, alternately hauled and slacked the boom line in time with the swing of the suspended bucket until the latter moved outward on a long arc in a vertical plane radial to the derrick mast and finally at the extremity of its path was quickly dumped by tripping the bottom latch, allowing the 3 tons of concrete to shoot through the air to the required position in a line considerably inclined from the vertical. This operation skilfully performed enabled the last few yards of the concrete to be deposited without moving the derrick, which otherwise would have been necessary.



SWINGING DUMP FOR A CONCRETE BUCKET AT LOCKINGTON DAM

Recent Legal Decisions

STREET WIDENING BENEFITS EQUALLY PROPERTY ON BOTH SIDES OF STREET

Since street widening benefits affect alike all property similarly situated which abuts upon or is adjacent to the street and the benefits cannot be affected by the side of the street the job is on, nor by the fact that a "job" removed happens to be on one side of the street instead of on the other, Washington Supreme Court holds, In re Phinney Avenue, in City of Seattle, 194 Pac. 977, that an assessment proceeding which results in the assessment of one tract of property seven times as great as it does another of like area and situation, is unjust and arbitrary, and should not be allowed to stand.

TAXPAYERS CANNOT, THROUGH COURTS, INTERFERE WITH DISCRETIONARY POWERS OF MUNICIPAL AUTHORITIES

The Colorado Supreme Court holds, Antero & Lost Park Reservoir Co. v. Lowe, 194 Pac. 945, that where discretion may be exercised by a municipality, it must be done by constituted authority, and the courts cannot, at the instance of a taxpayer, interfere with the exercise of such discretion or substitute the judgment of the court for the judgment of those in authority. A taxpayer may protect the rights of the municipality against the unlawful increase of taxes which would throw an unlawful charge or burden upon his property, but he cannot by the exercise of discretionary power vested in others force additional burdens and taxes upon the taxpayers of the municipality.

MEASURE OF PAYMENT BY CITY FOR BENEFITS RECEIVED FROM PERFORMANCE OF VOID CONTRACT

The Minnesota Supreme Court holds, Fargo Foundry Co. v. Village of Calloway, 181 N. W. 584, that where a city or village contracts for a municipal improvement which it has power to make, but the contract is void because not made after competitive bidding as required by law the village is obliged to pay for any benefit it receives through performance of the contract, not because of the contract, but because of a general obligation to do justice. The measure of recovery is not the value of material and cost of labor, but the amount of benefit the village receives. If some part of the work is of value and another part a detriment, the net benefit is the measure of the city's obligation to pay.

CONTRACT NOT NECESSARILY ILLEGAL BECAUSE MATERIAL PURCHASED FROM MEMBER OF COUNCIL

The New Jersey Court of Errors and Appeals holds, Fredericks v. Borough of Wanaque, 112 Atl. 309, that, while a member of a municipal body who enters into a corrupt contract forbidden by the New Jersey Crimes Act, section 32, is guilty of a misdemeanor, and the contract itself is thereby void, yet in the absence of a corrupt understanding or agreement of the contractor with the member of the council voting for the contract to evade the act, a resolution of the municipality, otherwise legal, is not rendered illegal by the subsequent action of the contractor in purchasing his material from a recognized source of supply, the proprietor of which happens to be a member of the governing body which awarded the contract; and the contract itself does not thereby become nugatory.

"SITE OF WORK" IN CONTRACT FOR HIGHWAY CONSTRUCTION

Where a contractor for the construction of a highway has agreed with a sub-contractor to deliver materials at the "site of the work," the Maryland Court of Appeals holds, Fisher v. Vandewater, 112 Atl. 296, that it was the contractor's duty to deliver such materials at points on the highway where they were needed for the work in the course of its normal progress and not at some point thereon remote from the scene of the subcontractor's operations.

STREET IMPROVEMENTS CAUSING INCREASED FLOW OF SURFACE WATER IN ADJOINING MUNICIPALITY

The Pennsylvania Supreme Court holds, Borough of Bridgewater v. Borough of Beaver, 112 Alt. 232, that, since every municipality has the right to the natural, proper and profitable use of its land if in the course of such use without negligence unavoidable loss is brought upon an adjoining municipality it is damnum absque injuria. Therefore where a borough has a legal right to open, grade, pave and improve its streets within a drainage area, and the owners of lots abutting on said streets have a right to erect houses thereon, fill up depressions therein and change the grades of their lots to conform to the changed grades of streets, damage to an adjoining borough by the increase in the quantity and velocity of surface waters drained into its streets by such street improvements is damnum absque injuria, which cannot be abated as a nuisance by the adjoining borough.

IN ABSENCE OF FRAUD OR AUTHORITY, PETITIONER FOR PAVEMENT CANNOT WITHDRAW AFTER APPROVAL BY CITY COUNCIL

The Nebraska Supreme Court holds, Wilkinson v. City of Lincoln, 181 N. W. 861, that in the absence of fraud or of statutory or municipal authority, a petitioner for a city pavement cannot withdraw his name after the petition has been duly approved and the pavement legally ordered by the city council. The court said: "The validity of municipal acts is not left to the changing attitude of private petitioners. Public policy does not permit a petitioner to invoke municipal power for the public welfare and, by withdrawing his name without specific statutory or municipal authority, destroy the power invoked by him after it has been legally exercised by the city council. This principle of municipal law is sound and is well established by precedent."

NEWS OF THE SOCIETIES

July 12-15—NATIONAL CONVENTION OF REAL ESTATE BOARDS. Chicago.

July 15—NEW ENGLAND ASSOCIATION OF COMMERCIAL ENGINEERS. Annual meeting. Crown Hotel, Providence, R. I.

Aug. 10-12—INTERNATIONAL ASSOCIATION OF STREET CLEANING OFFICIALS. Annual conference. Hotel La Salle, Chicago, Ill.

Aug. 23-25—AMERICAN ASSOCIATION OF PARK SUPERINTENDENTS Annual meeting. Detroit, Mich. Secretary, Emmet P. Griffin, Superintendent of Park, East St. Louis, Ill.

Aug. 30-Sept. 1—MICHIGAN STATE GOOD ROADS ASSOCIATION. Annual meeting. Flint, Mich.

Sept. 13-16—NEW ENGLAND WATER WORKS ASSOCIATION. 39th annual convention. Bridgeport, Conn. Secretary, Frank J. Gifford, 715 Treont Temple, Boston, Mass.

Sept. 28 (10 days)—NEW YORK ELECTRICAL EXPOSITION. Seventy-first Regiment Armory, New York City.

Oct. 11-14—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual Convention, Atlanta, Ga. Hotel Ansley. Secretary, James J. Mulcahey, Municipal Building, Denver, Colo.

Oct. 24-28—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Southern Hotel, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

Oct. 31-Nov. 5—NEW ENGLAND ASSOCIATION OF COMMERCIAL ENGINEERS. Power show in connection with INTERNATIONAL TEXTILE EXPOSITION. Mechanics' Building, Boston, Mass. Secretary, James F. Morgan, Devonshire st., Boston.

Nov. 14-18—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS

The twenty-fourth annual meeting was held at the New Monterey Hotel, Asbury Park, N. J., June 20-24, 1921.

The first session was devoted to reports from the committees: On Coal, A. C. Fieldner, chairman; on Coke, Richard Moldenke, chairman; on Timber, Hermann von Schrenk, chairman; on Shipping Containers, J. A. Newlin, chairman; on Rubber Products, F. M. Farmer, chairman; and on Screen Wire Cloth, R. W. Woodward, chairman.

Second session: Report of committee on Preservative Coatings for Structural Materials, Allen Rogers, chairman; The Use of Secondary Reference Standards in Process Problems of Color Measurement, H. S. Busby; Stress-Strain Measurements on Films of Drying Oils, Paints and Varnishes, H. A. Nelson; Plastic Flow through Capillary Tubes, E. Buckingham; Textile Materials, A. E. Jeury, chairman.

Third session: Presidential address and reports of administrative committees, followed by an informal dance and smoker, Tuesday evening, June 21.

Fourth session, report of committee on Reinforced Concrete, Richard L. Humphrey, chairman. Progress report of joint committee on Standard Specifications for Concrete and Reinforced Concrete. A Proposed Method of Estimating the Density and Strength of Concrete and of Proportioning the Materials by the Experimental and Analytical Consideration of the Voids in Mortar and Concrete, A. N. Talbot. Time of Set of Concrete, Watson Davis. A Comparison of the Results of the Slump Test and the Flow Table in the Measurement of the Consistency of Concrete, W. L. Schwalbe. Variation in the Effect of Rodding Concrete, F. E. Giesecke. Testing of Plastic Calcined Magnesite for Use in Oxychloride Cements, M. Y. Seaton. Wear Tests of Concrete. D. A. Abrams.

Fifth session, report of committee on Road and Paving Materials, A. H. Blanchard, chairman. Tests for Soils with Relation to Their Use in the Subgrade of Highways, A. T. Goldbeck and F. H. Jackson. Measurements of Impact of Motor Trucks on Roads, E. B. Smith. Report of committee C-9, on Concrete and Concrete Aggregates, Sanford E. Thompson, chairman. A Study of the Composition of Blast Furnace Slags Suitable for Concrete Aggregate, L. G. Carmick. Fire Tests of Building Columns, S. H. Ingberg.

Sixth session, on ceramics, lime and gypsum. Report of committee on: Brick, H. T. Shelley, chairman; on Clay and Cement Sewer Pipe, Rudolph Hering, chairman; on Drain Tile, A. Marston, chairman; on Lime, H. C. Berry, chairman; on Refractories, W. H. Fulweiler, secretary; on Hollow Building Tile, W. A. Hull, chairman; on Gypsum, W. E. Emley, chairman.

Seventh session, on testing and nomenclature. Report of committee on: Methods of Testing, J. A. Capp, chairman; on Metallography, W. H. Bassett, chairman; on Nomenclature and Definitions, Cloyd M. Chapman, chairman; on Electrical Insulating Materials, F. M. Farmer, chairman; a Method of Determining the Tensile Strength of Porcelain, F. H. Riddle and J. S. Laird. Magnetic Spring Testing, T. Spooner and I. F. Kinnard; a Study of Elastic Viscous Deformation, P. G. Nutting.

Eighth Session, report of committee on Petroleum Products and Lubricants, C. P. Van Gundy, chairman. Refining of Petroleum, C. K. Francis. Improvements in Apparatus for Testing Petroleum Products, T. G. Delbridge. Problems Involved in the Development of Specifications for Motor Gasoline, E. W. Dean.

Presentation of a motion picture on "The Story of Petroleum," presented through the courtesy of the United States Bureau of Mines.

Ninth session, on steel and wrought iron.

Golf and tennis tournaments on Friday afternoon, June 24.

Tenth session, on cast iron, corrosion and non-ferrous metals.

The attendance of 610, only 10 per cent less than the highest previous record, was considered exceedingly good, especially in view of the high railroad fares. Abstracts of some of the most important reports of committees will be published in PUBLIC WORKS.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS

The committee of Paving Brick Specifications of the American Society for Municipal Improvements held a special meeting at Asbury Park, N. J., June 20, 1921. A revision of the brick specifications was discussed and E. S. Rankine, of Newark; W. P. Blair, vice-president of the National Paving Brick Manufacturers' Association; and Wm. C. Perkins, chief engineer of the Eastern Paving Brick Manufacturers' Association, were granted a hearing.

WESTERN SOCIETY OF ENGINEERS

At the annual dinner of the Western Society of Engineers held in Chicago on June 8, the society was addressed by the retiring president, Frederick K. Copeland, the incoming president, Charles H. MacDonweel and by Dr. R. A. Millikan on the "Organization of Research in a Democracy."

ROCHESTER ENGINEERING SOCIETY

At its annual meeting on June 10, the Rochester (N. Y.) Engineering Society elected the following officers: President, Harold O. Stewart; first vice-president, Charles C. Evans; second vice-president, Waldo G. Wildes; secretary, Gloster P. Havenor; and treasurer, Louis J. Summerhays.

NATIONAL ELECTRIC LIGHT ASSOCIATION

About 300 delegates were present at the annual convention of the North Central division of the National Electric Light Association, which was held in Duluth on June 21-23. Electrical manufacturers within a radius of 500 miles of this city sent exhibits to be displayed at the meeting. Other interesting features of the meeting were discussions on public utilities, general business conditions, fuel supply problems and similar subjects; tours about the city and visits to sources of power in the vicinity; also entertainments for the women of the party.

PERSONALS

Upham, Charles M., state highway engineer of Delaware, has been granted a year's leave of absence beginning September 1, to accept the position of state chief engineer with the state highway department of North Carolina.

Clark, B. E., acting state engineer and acting state highway commissioner of Oklahoma, has been appointed state highway commissioner of Oklahoma by Governor Robertson.

Harper, L. L., has been appointed city engineer of Quincy, Ill.

Givan, Albert, has been appointed city engineer of Sacramento, Cal.

Cogswell, William B., founder of the Solvay Process Co., at Syracuse, died at his home in that city on June 7.

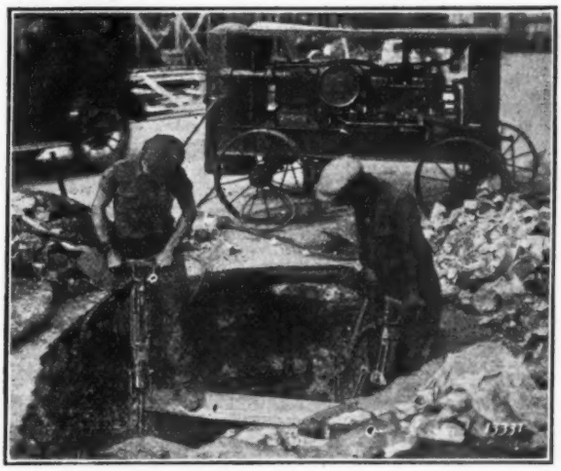
Boehringer, R. A., of the Akron, Ohio, water department, is now resident engineer of the Reading, Pa., water works.

Cauchon, Noulan, has been appointed chairman of the Ottawa Town Planning Commission.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

THE PAVING BREAKERS HAVE CUT THROUGH THE ASPHALT SURFACE, BROKEN UP THE CONCRETE SUB-BASE AND LOOSENED THE COMPACT SOIL



PAVING BREAKERS DESTROYING CONCRETE AND MASONRY FOR THE ENLARGING OF MAN-HOLE

PAVING BREAKERS

By the use of paving breakers, which are one-man pneumatic hand tools similar in construction to non-rotating hand hammer rock drills, operated by portable compressors, both manufactured by the Ingersoll-Rand Company and described in their bulletin entitled "Paving Breakers," it is claimed that asphalt and concrete pavements and the like can be cut for the installation of pipes, conduits and for repairs and new construction, with a saving in the cost of about 67 per cent and of time of about 75 per cent as compared with ordinary hand methods.

The breakers, which are of two sizes, weigh 58 and 68 pounds, respectively, are all steel, principally drop forged, and are of simple rugged construction with T handle in which is incorporated a simple trigger throttle valve. Undue shock is absorbed by the springs, and they are provided with bits having chisel edges for cutting asphalt, bitulithic block, etc., and a moil point for breaking or spawling concrete, loosening paving stones, breaking frozen or compact ground. The light machine is recommended for use with an air pressure of 80 pounds and the heavier one for pressures of less than 80 pounds.

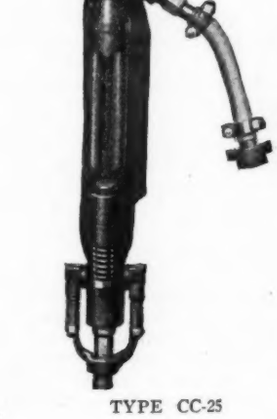
When the breakers are used for street railway work the air pressure is generally furnished by an Imperial tie tamper compressor and for other purposes, such as street paving, trenching and contract work, the Imperial Type 14 portable air compressor, driven by gasoline or electricity, is generally used. Any of these compressors will operate two paving breakers.

The average efficiency of good hand work in cutting through an asphalt pavement 3 to 6 inches thick and a 6-inch concrete base is about 10 linear feet per man per 8-hour day. Three men with a compressor and two paving breakers will average 300 linear feet of the same work in the same time, according to the record of a large eastern company using four of the outfits which they consider pay for themselves every month. One paving breaker and two men working for the Los Angeles Railway Corporation replaced 30 men, at $4.35 each doing the same work.

TURBIDITY AND COLOR INSTRUMENTS

Instruments for the accurate determination of the amount of color and turbidity in water, and for measuring them on standard scales are manufactured by the Builders' Iron Foundry, who supply turbidity apparatus recommended by the United States Geological Survey in Water Supply and Irrigation Paper No. 151 and in Circular No. 8 of the Division of Hydrography.

The instruments are based on the platinum-cobalt method of measure-



TYPE CC-25

ILLUSTRATING THE APPLICATION OF PAVING BREAKERS ON ELECTRIC STREET RAILWAY WORK

TYPE BC-25

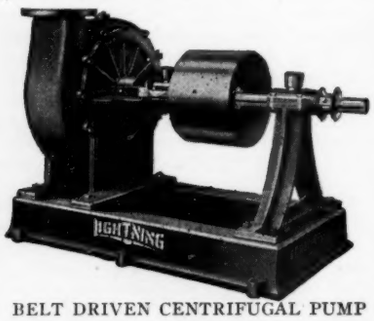
ment, devised by Allen Hazen, which compares the color of the given water with that of a standard Platinum-Cobalt solution, diluted to form a graded color scale, each solution being numbered to correspond with the number of parts of metallic platinum in 1,000,000 parts of the solution.

The apparatus consists of a tube containing 6 standard colored glass discs corresponding in color to the solutions indicated. There are three aluminum tubes, 50, 100 and 200 millimeters in length for containing the water to be tested.

The same company also manufactures a turbidity scale 8 inches long with an attached tape line which can be immersed in the water and will indicate the amount of turbidity by the depth of immersion necessary to cause a platinum wire at the bottom of a scale to become invisible. These instruments are especially valuable for use in designing filtration plants and for proportioning settling basins, for determining the slope of irrigation canals and for other purposes.

LIGHTNING CENTRIFUGAL PUMPS

Lightning centrifugal pumps have been manufactured for 25 years by the Kansas City Hay Press & Tractor Co. They have a runner with integral sides, the shaft is made with reversible ends, there is a special brass sleeve to prevent sand from entering the stuffing box and two collars to avoid end thrusts. The pumps can be changed from right hand to left hand, and are all constructed so as to discharge at any desired angle. A specialty is made of dredging pumps. The suction and discharge pipes are made of the same size and they are especially well adapted for pumping sand for dredging and filling.



BELT DRIVEN CENTRIFUGAL PUMP

Water pumps are made in four sizes with capacities of 40,000 to 162,000 gallons per hour raised to heights from 5 to 80 feet according to speeds varying from 166 feet to 375 feet. Sand and water pumps are also made in four sizes, capacities of 72,000 to 450,000 gallons per hour. Dredge pumps have an efficiency of 40 to 50 per cent and can handle an average of 10 to 15 per cent of suspended material which may increase to as much as 40 per cent under certain most favorable circumstances.

NATIONAL MULTIPHASE RENEWABLE FUSE

Electrical manufacturers have been working for years to develop a means to prevent Multiphase, (Polyphase) motors running single phase.

The Federal Electric Company of Chicago have developed, with basic patent protection, a low voltage auxiliary coil which is embodied in the renewable cartridge of National Renewable Fuses.

The new device serves two purposes: First, as a fuse it is so constructed that it withstands the high starting current of motors, yet protects the running load within the limits prescribed by the Underwriters' Laboratories, Inc.

As the fuse is made for operation on Multiphase circuit, it acts as a circuit breaker; that is, when one fuse blows, the auxiliary device in the National Multiphase Renewable Fuse makes one of the other elements in one of the other fuses blow, thereby breaking the circuit entirely and eliminating the possibility of the motor running as a single phase motor. This is really a time limit fuse and is absolutely fool-proof.

NEW ROAD MAINTAINER

A new machine just put into the road maintainer field is a one-man outfit departing entirely from familiar design, built with one front wheel and two large drive wheels in the rear, the grader blade being swung underneath and just in front of the operator, giving him a chance to see just what he is doing.

The only purpose of this machine is the proper and economical maintaining of dirt roads through the continuous system of road patrol maintenance, started in Wisconsin and rapidly spreading to all parts of the country.

The "One-Man" outfit, with its 6-cylinder motor developing 8 horsepower on the blade replaces two or three teams and two or three men. The operator sits at the rear of the tractor with the blade in front of and below him, so that he is sitting in a comfortable natural position and can see exactly what work is being done. The blade attachment is 12 feet long and is swung at an angle underneath the machine on a sub-frame which is bolted to the main frame. The blade itself, made in three sections, is adjustable both to the curvature of the road and the depth of the cut.

As the blade angles between the rear of the left drive wheel and the front of the right, it makes a cut 9½ feet wide. The outside right-hand blade is placed in a more angular position. In operation it thus keeps the dirt always rolling towards the center. This blade is especially convenient in cleaning out ditches or gutters.

In crowning a road the center of the blade is raised and the dirt will then roll to either side, leaving a smooth, perfectly crowned highway or street. Four levers, within easy reach of the operator, control the three sections of the blade quickly and easily.

This machine may be used for hauling loaded wagons, in construction work, or hauling scrapers and other road machines used in highway maintenance. It can also be equipped with a belt pulley for operating a small rock crusher or other belt machines.

The powerful 6-cylinder motor develops sufficient power for pulling the blade to any depth desirable. With the 3-speed transmission, it is possible to go over the road slowly when it is rough, and faster as it becomes smooth.

STOCKLAND ROAD GRADERS

The road grading machines described in the catalog of the Stockland Road Machinery Co. have been manufactured for 20 years, more than 1,000 are now in operation, and it is claimed that their use secures better roads and cuts the grading cost 17 per cent. An exclusive feature is the quick lift lever that makes the machine a non-stop grader by enabling the operator to lift the blade instantly and pass over any obstruction while the curved blades cut under the soil instead of scraping and pushing, and the steering device makes the control of the machine positive and easy. The blade can be shifted transversely, tilted at different angles, or completely reversed.

The graders are made in 6 sizes, the Giant of 25 h. p., weighing 8,200 pounds; Giant, Jr., 5,700 pounds; Special, 3,585 pounds; Standard, 3,100 pounds; Junior, 1,550 pounds, and the 1,000-pound Pony which can be operated by two horses. The new Giant is built for heavy road work to be hauled by a 30-60 or a 75-120 h. p. traction engine.

The Giant scarifier weighs 9,800 pounds, has 7 teeth 3½ inches square and cuts a swath 6 feet wide in macadamized, hard clay, or gravel roads. Any Giant Stockland grader can be converted into a scarifier machine.

The Northwest special drag is made by the same company in two sizes with blades 8 feet and 7 feet long, weighs 360 pounds and 335 pounds, respectively. The Northwest Junior drag is similar to the Special drag, but lighter.

TRADE PUBLICATIONS

MROM TREE TO TRADE

The Long-Bell Lumber Company has issued a handsome 46-page pamphlet richly illustrated with colored engravings that contains interesting and valuable statistics and descriptions under the head of The Forest Park Commission, Building, Modernizing a Great Industry, Community Life in the Lumber Industry, Life in the Logging Camps, Lumber in the Making, Quality in Lumber, Creosoted Wood Products, Finished Products from Western Woods, American Lumber in Foreign Countries, and Farm Lands in the Wake of the Woodman. Interesting details are given of the processes and equipment for logging, transporting and sawing lumber and interesting data regarding the products of the company which include Southern pine, lumber and timber, creosoted lumber and timber, oak and gum lumber and flooring, California white pine lumber and sash, doors and standardized woodwork.

TRAILMOBILES

Trailmobile Co., Cincinnati, Ohio, issues circular descriptive of trailmobiles, with four wheels, for hauling by teams, trucks and automobiles and of semi-trailmobiles with two wheels supporting rear end and a special bearing supporting the forward end on the rear truck of the automobile.